Boring Insects? – Not!

Managing wood borers and bark beetles

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Colorado State University

63rd Annual Shade Tree Conference
Topeka, KS January 10, 2018

Insects that Develop under the Bark of Trees, Shrubs

Bark Beetles

Wood Borers

Tip Moths, Twig Borers

Wood Borers

Some General Features of Wood Borers

- **Eggs are laid singly on, into, or just underneath the bark**
- **The larvae enter the woody parts of the plant (branches, trunk, roots) to feed**
- **Primary feeding sites vary by species**
  - Cambium and associated Phloem, Xylem
  - Heartwood
  - Roots

Several insects work as borers:

- Some beetle larvae (Coleoptera)
  - Flatheaded borers/Metallic wood borers
  - Roundheaded borers/Longhorned beetles
- Some moth larvae (Lepidoptera)
  - Clearwing borers
  - Carpenterworms
  - Pyralid borers
- Some wasp larvae (Hymenoptera)
  - Horntails

Flatheaded Borers/Metallic Wood Borers

Coleoptera: Buprestidae

Flatheaded Borer

Larvae make meandering tunnels packed with fine grained sawdust

Granular sawdust is typically excreted and packs the larval tunnels

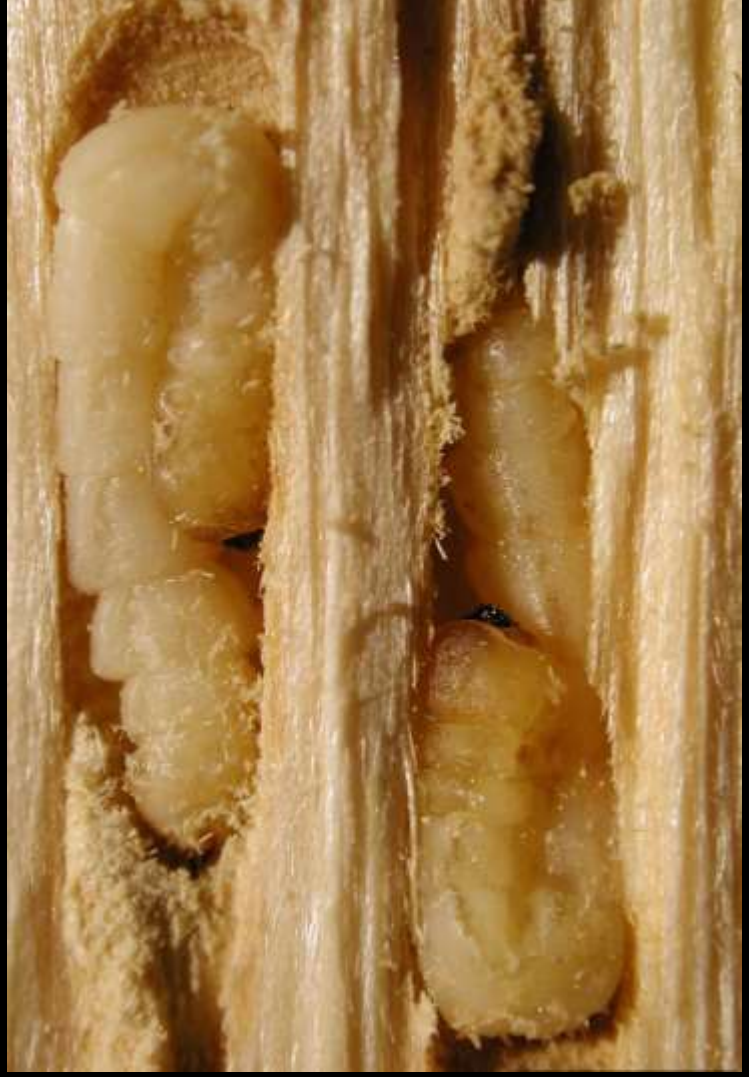
Many flatheaded borers are “non-aggressive” and limit their tunneling to areas of the trunk that were previously damaged or recently killed by pathogens

Outbreak attacks by flatheaded borers can extensively destroy the phloem and outer xylem of trunks or limbs

On thin-barked hosts external evidence may be raised ridges of the bark where the tree has formed callus tissue in response to borer wounding

Thinning of the crown is a common symptom of flatheaded borer infestation

This is the result of the cumulative effects from the larval tunneling.



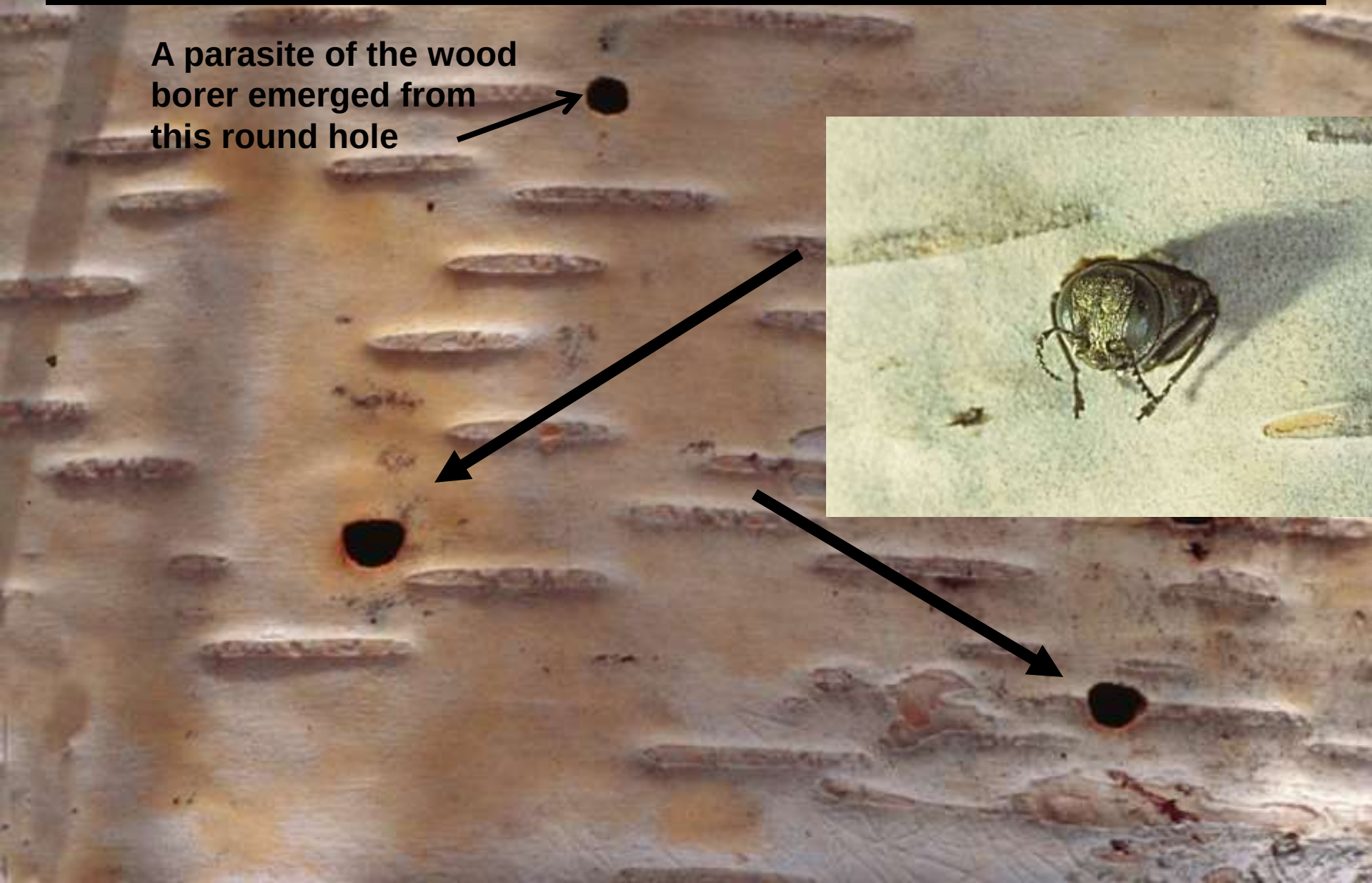
After the larva is full-grown……

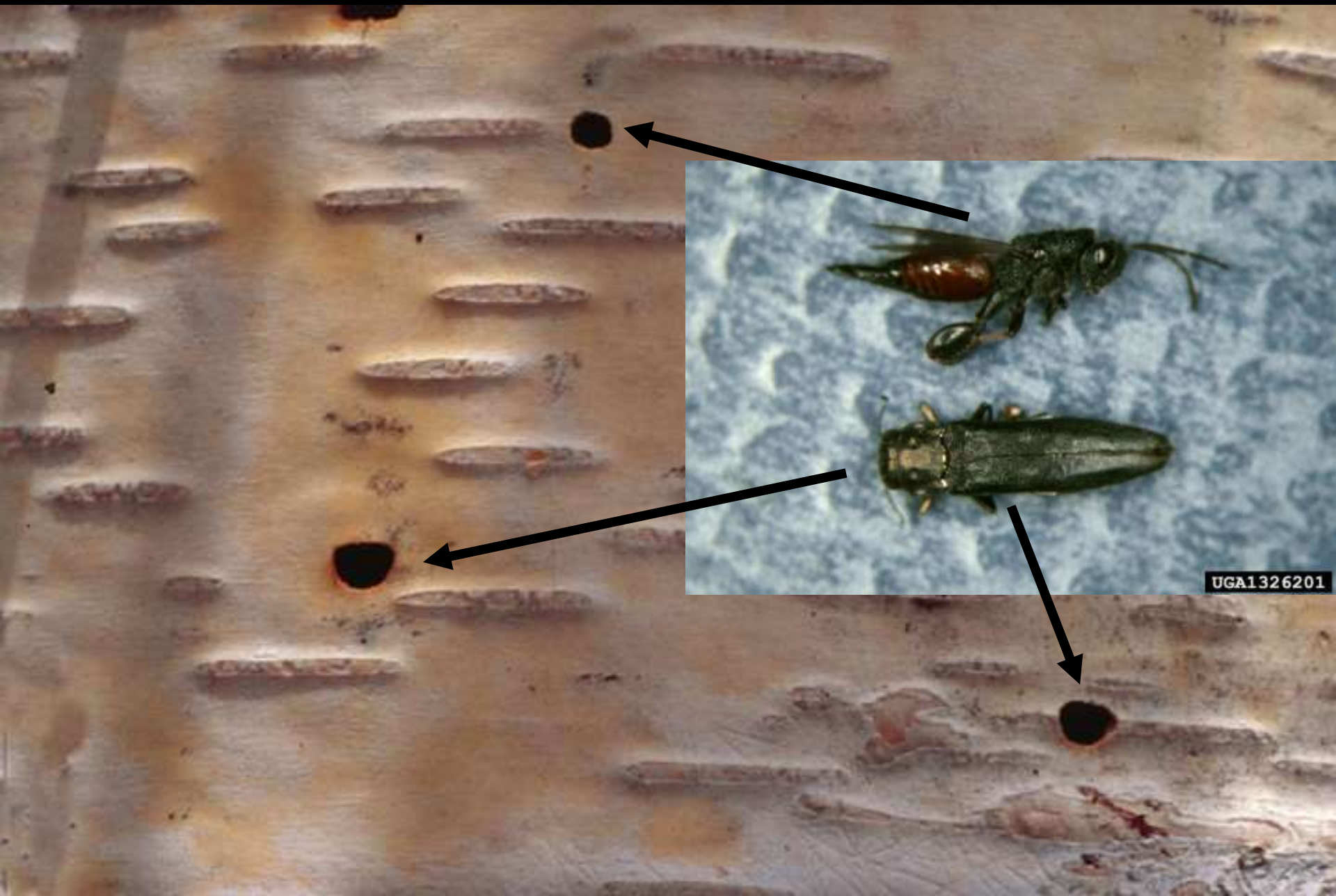
….it will pupate under the bark.

The adult later chews its way through the bark to exit the plant.

D-shaped exit hole produced by emerging metallic wood borer

D-shaped exit holes produced when adult bronze birch borers emerged from the tree

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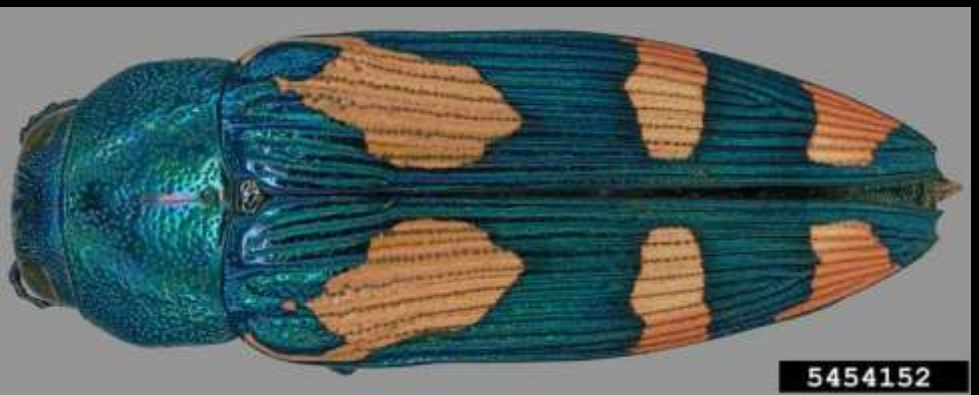
D-shaped exit holes made by flatheaded appletree borer

Metallic Wood Borer

Adult form of a flatheaded borer

Some metallic wood borers have bright coloration



Photographs on left courtesy of Steven Valley, Oregon Department of Agriculture

Earrings made from wing covers of a metallic wood borer

Four common *Agrilus* species metallic wood borers

Emerald Ash Borer: Up-Date 2017

1. Emerald ash borer has been detected in 8 counties in Kansas.

2. Second edition (2014) of publication; <u>Insecticide Options for Protecting Ash Trees from Emerald Ash Borer.</u>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Adults insert eggs into protected sites such as bark cracks and under flaps of loose bark.

Eggs on bark

Egg shortly before hatch

Diagnosis – Flatheaded Borer Injury

- Meandering tunnels produced under the bark
  - Tunnels packed with fine sawdust
- Plant shows decline/thinning crown
- D-shaped exit holes in bark

Roundheaded Borers/ Longhorned Beetles

Coleoptera: Cerambycidae

Pine Sawyers

Hosts: Pines

Cottonwood Borer

Hosts: Cottonwood, poplars, willow

Locust Borer

Host: Black locust

Poplar Borer

Hosts: Aspen, poplars

When laying eggs, the female longhorned beetle first chews a pit in the bark. She later lays an egg into the pit.

The egg is inserted underneath the bark; it is not laid on the surface.

Roundheaded Borer

Coarse sawdust expelled from tree by roundheaded borer


UGA3067015

The adult longhorned beetle chews its way through the bark. An oval-round exit hole is produced.

Adults feed on foliage or twigs, but the resultant injuries that are rarely noticeable

Diagnosis – Roundheaded Borer Injury

- Tunneling penetrates into heartwood of the tree
  - Riddling, structural weakening
- Coarse sawdust typically produced
- Oval-round exit holes in bark

Clearwing Borers

Lepidoptera: Sesiidae

Adult clearwing borers are day-flying moths that mimic bees and wasps.

Some Common Clearwing Borers of the Region

- Peach tree borer (*Prunus* spp.)
- Lilac/Ash borer (ash, lilac, privet)
- Currant borer (*Ribes* spp.)
- Viburnum borer (*Viburnum* spp.)
- Raspberry crown borer (raspberry)
- Cottonwood crown borer (Cottonwood)

Larvae chew, irregular gouging wounds under the bark.

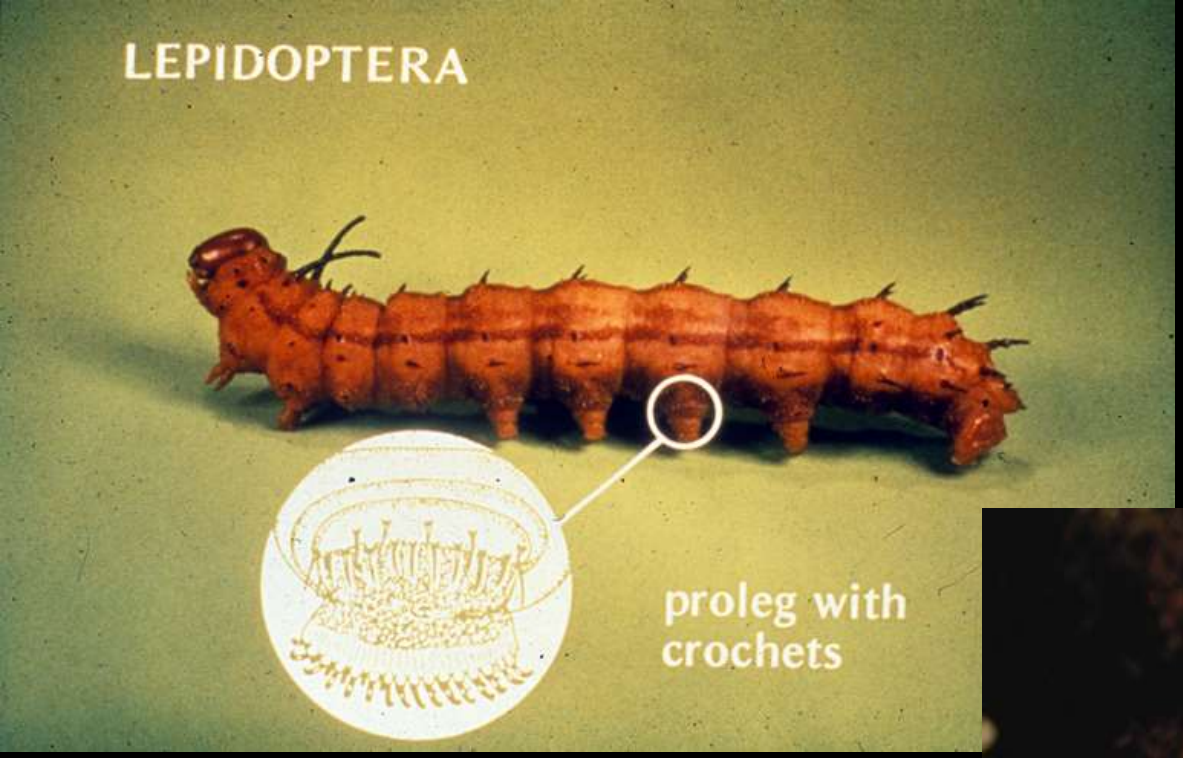
Most larvae of clearwing borers feed at or below the soil surface – the crown area of the roots – and may be known as crown borers.

What kind of wood borer do you have?

Clearwing borer? (Lepidoptera)

Flatheaded borer? (Coleoptera)

Roundheaded borer? (Coleoptera)



All larvae of moths and butterflies (Lepidoptera) have prolegs on the abdomen.

These legs are tipped with hooks, the crochets.

Prolegs on the abdomen, tipped with the crochets

Top view of peachtree borer larva

Photographs courtesy of David Shetlar, Ohio State University

Bottom view of peachtree borer larva

Top (dorsal) side, and bottom (ventral view of a Zimmerman pine moth larva

Photograph courtesy of Jim Kalisch, University of Nebraska

Lilac/Ash Borer

Podosesia syringae

Larvae of the lilac/ash borer are known to damage ash, lilac and privet.

In Colorado it has proven to be primarily an insect associated with ash trees in sites with some growing stresses

Lilac/ash borer injury to base of ash - exterior

Lilac/ash borer damage to base of ash -interior

Exit holes made by the adult moth upon emergence are slightly oval, nearly round

Lilac ash borer adults emerge early in the year – sometimes beginning in late April

Peachtree Borer
(aka Peach Crown Borer)

Synanthedon exitiosa

Peach tree borer larvae feed at the crown area of the plant or on larger roots

Pupation occurs with a cocoon, covered with bits of wood chips, and is produced just beneath the soil line.

The moth, as it emerges, draws out the skin that had surrounded the pupa

The pupal skins may be observed around the base of infested plants.

Upper left: Peach tree borer female

Upper right: Peach tree borer male

Lower left: Pupal skin extruded from case of silk and wood fragments

After mating, the females lay eggs on the surface of the bark, near the base of the plant

Raspberry Crown Borer

Pennesetia marginata

Adult (a yellowjacket mimic)

Larva in the base of the plant

Diagnosis – Clearwing Borer Injury

- Tunneling often concentrated at the base (root crown) of the plant
- Tunneling an irregular gouging
- Pupal skins often are pulled out upon adult emergence

Pyralid Borers

Lepidoptera: Pyralidae

Zimmerman pine moth, pinyon pitch mass borer, pitch twig borer

Pinyon pitch mass borer

Dioryctria ponderosae

Zimmerman pine moth

Dioryctria zimmermani

External evidence – Zimmerman pine moth

Larvae exposed from trunk, branch

Exterior evidence of
Zimmerman pine moth damage

Prolegs on the abdomen, tipped with the crochets

Top view of peachtree borer larva

Photographs courtesy of David Shetlar, Ohio State University

Bottom view of peachtree borer larva

Top (dorsal) side, and bottom (ventral view of a Zimmerman pine moth larva

Photograph courtesy of Jim Kalisch, University of Nebraska

Life history quirk – Zimmerman pine moth

Adults are active in July, August and lay eggs
Eggs hatch within a couple of weeks

Upon hatch the caterpillars feed on the surface for a brief while.

They then produce a protective cocoon (hibernaculum) and remain on the bark through winter

Life history quirk – Zimmerman pine moth

In late April, May the larvae emerge from the hibernaculum and bore into the tree

Importance: *Zimmerman pine moth is exposed on the exterior from late August through late April*

Diagnosis – Pyralid Borer Injury

- Species all associated with conifers, usually pine
- Tunneling an irregular gouging
  - Often concentrated at crotches
- Whitish pitch produced at wound
  - Soft, pink
  - Crusty, popcorn like

Carpenterworm

Lepidoptera: Cossidae

Hosts: Many hardwoods

Note: Very long life cycle (2-4 years)

Horntails

Hymenoptera: Siricidae

Pigeon tremex – a wood boring wasp of deciduous trees in decline

Adults emerge from round exit holes

Wood Borer Management

- Optimize conditions for plant growth
- Sanitation
- Preventive applications of insecticides

Plant Health Care and Wood Borer Prevention

- Proper selection of plant material
- Appropriate siting in the landscape
- Good site preparation, planting conditions
- Provision of adequate watering

Note: Fertilization can produce mixed effects on borer resistance

Example: Birch and bronze birch borer

Wood Borers and Plant Stress

- Plant defensive responses are diminished
  - Related to stored photosynthate and water availability
- Plants may be slightly more attractive to adults when they lay eggs

Trap trees used to detect emerald ash borer

Girdled trees produce compounds attractive to adults

Girdled trees have changes in foliage color reflectance

Girdled trees have reduced ability to defend against borers feeding in the tree

Sanitation and Wood Borers

- Elimination of potential brood wood
- Prune-out of infested wood

Proper disposal of infested wood is important.

Preventive Use of Insecticides

Treatments are not available for borers currently in a plant

Preventive Use of Insecticides

Timed to periods when insects exposed

Evidence of adult borer activity – observation of the adults, pupal skins

Approximate Periods when Adult Stages of Some Borers are Active

- **Lilac/ash borer – late April-early June**
- **Emerald ash borer – late May-July**
- **Bronze birch borer – late May-July**
- **Zimmerman pine moth – August-September**
- **Locust borer – August-September**

Life history quirk – Zimmerman pine moth

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Pheromone Traps – A tool for monitoring some insects

Pheromones and Insect Management

- Pheromones are chemicals used to communicate between members of the same species

Pheromones and Insect Management

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- Insects use many kinds of pheromones
  - Sex
  - Aggregation
  - Alarm…… and many other things

Pheromones and Insect Management

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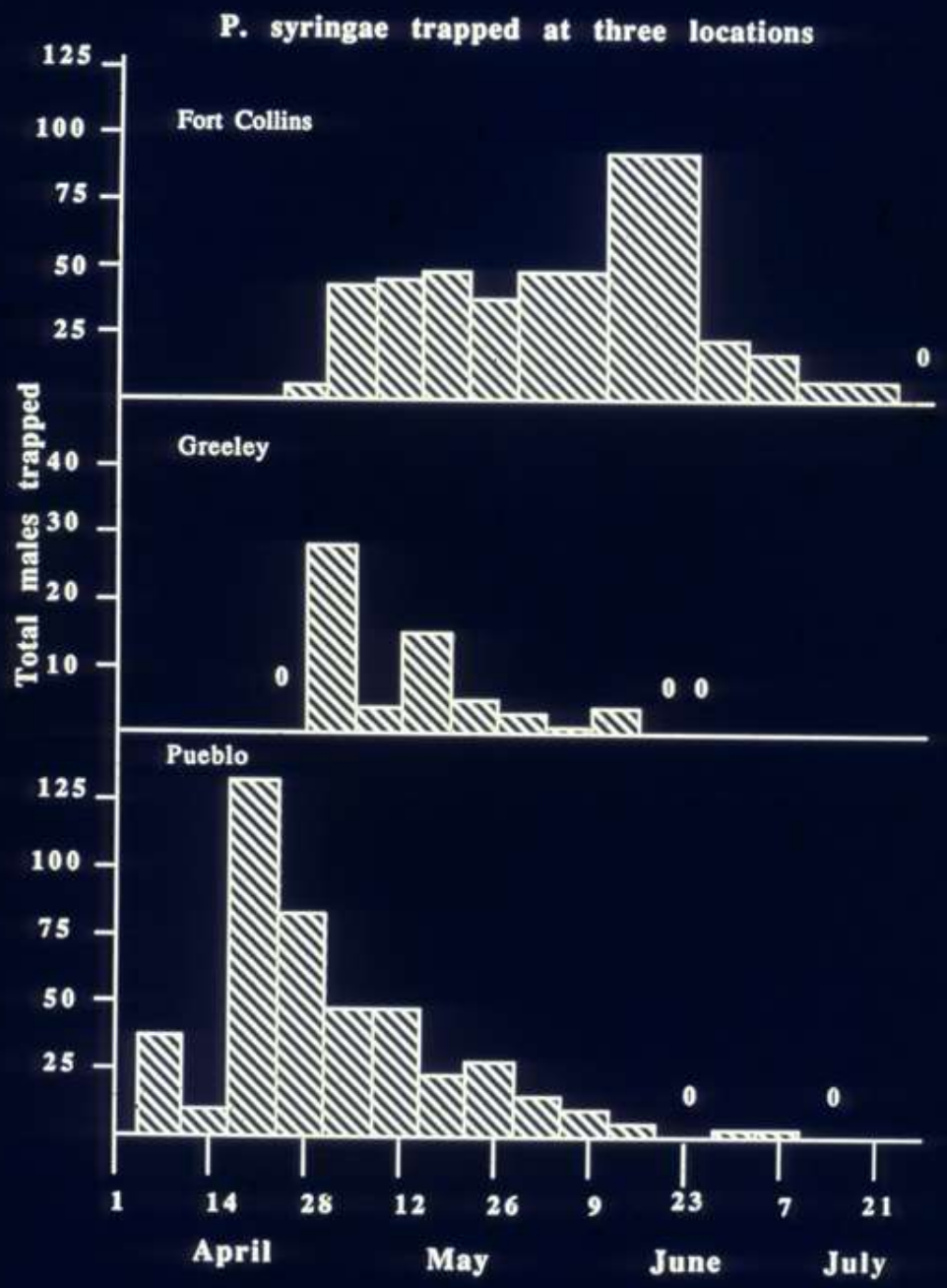
- Insects use many kinds of pheromones
  - Sex
  - Aggregation
  - Alarm…… and many other things
- **Sex pheromones of some moths are used in pest management**

Pheromone trap data for lilac ash borer

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SCENTRY

Pheromone Traps Available for for Borers

- Most clearwing borers

- Carpenterworm

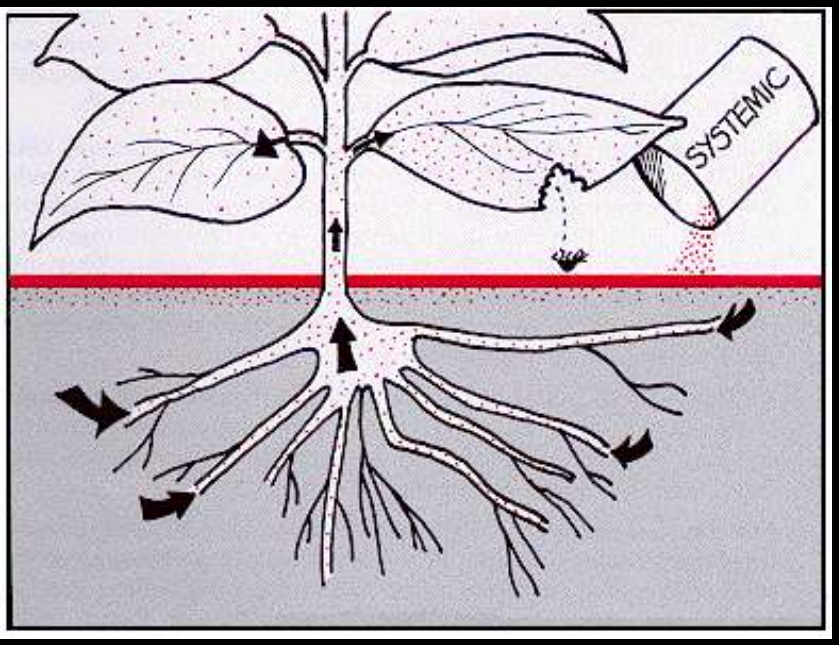
Active Ingredients of Wood Borer Insecticides (Trunk Sprays)

- Permethrin (Astro, etc.)
- Carbaryl/Sevin
- Bifenthrin (Onyx, Talstar)

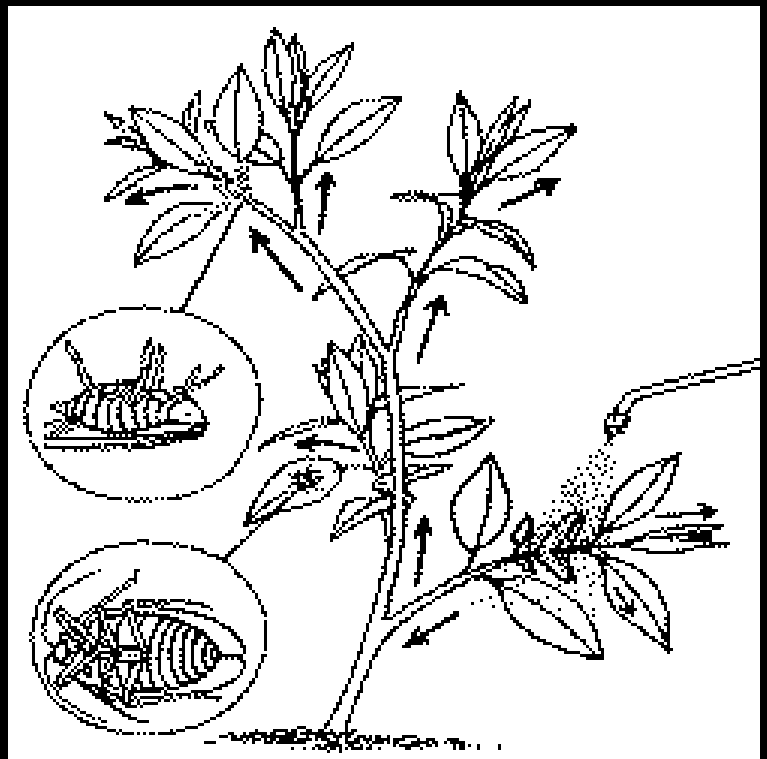
Key Timing Point in Wood Borer Prevention

Target exposed life stages

(Egg Laying/Egg Hatch)



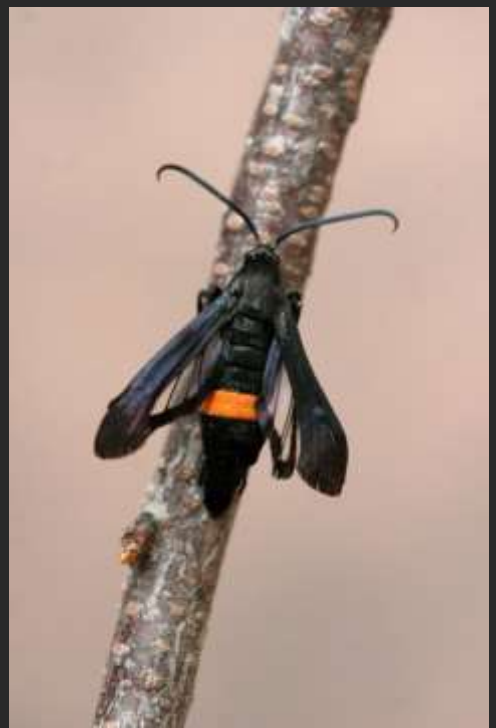
Systemic insecticides for wood borers?



Imidacloprid for Borers?

Yes*.....but*

Imidacloprid *will not* work well on borers that are the larval stage of moths



Lilac/ash borer larvae

Peach tree borer larval tunneling in base of plant

Zimmerman pine moth injury

Imidacloprid *will not* work well if the borer spends much of its life in the heartwood of the plant

Imidacloprid soil drenches *may work well* against flatheaded borer larvae (aka metallic wood borers)

Four common *Agrilus* species metallic wood borers

Emerald Ash Borer Control Options

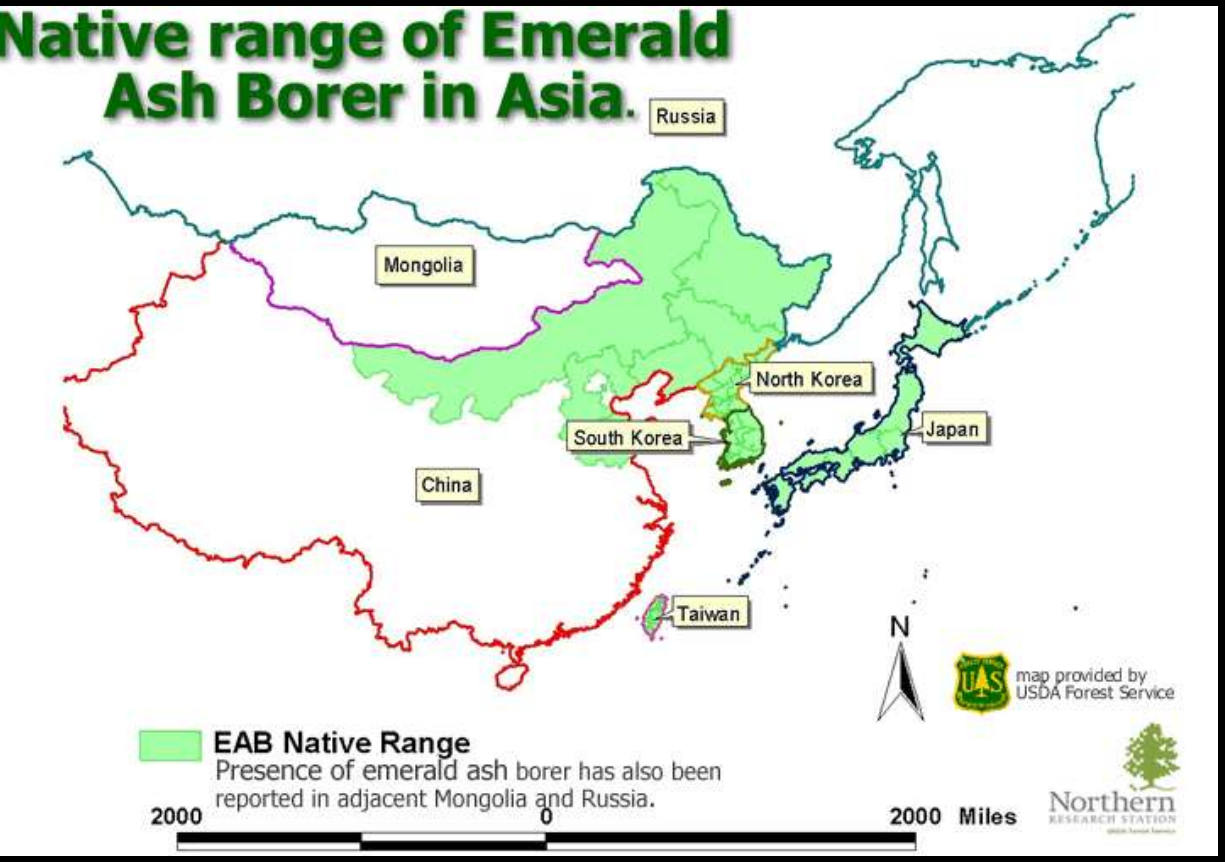
- Soil applications with systemic insecticides
  - imidacloprid, dinotefuran
- Non-invasive trunk sprays of systemic insecticides
  - dinotefuran
- Trunk injections of systemic insecticides
  - Emamectin benzoate (Tree-Age, others), azadirachtin (Treeazin, others), imidacloprid

Handling Emerald Ash Borer in the Western States

Emerald ash borer (EAB) is a green-colored beetle…….

…that develops in ash trees (*Fraxinus* species)…

……and is Native to Asia



Larvae tunnel under the bark girdling the cambium and surrounding tissues.

Photo by Edward Czerwinski

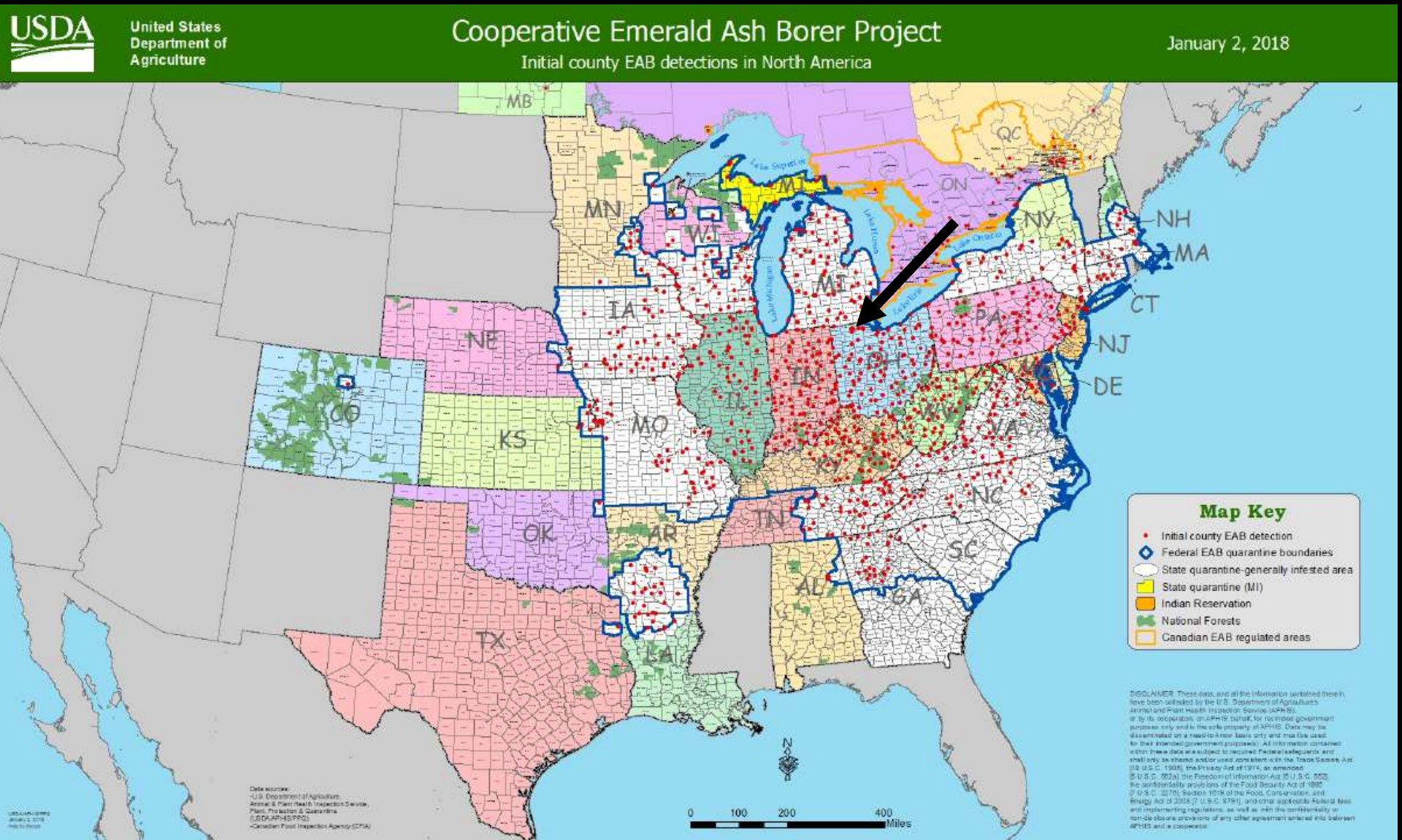
Effects of larval tunneling are cumulative, and ultimately lethal to the tree. Most trees are dead within 5 years after the initial colonization.

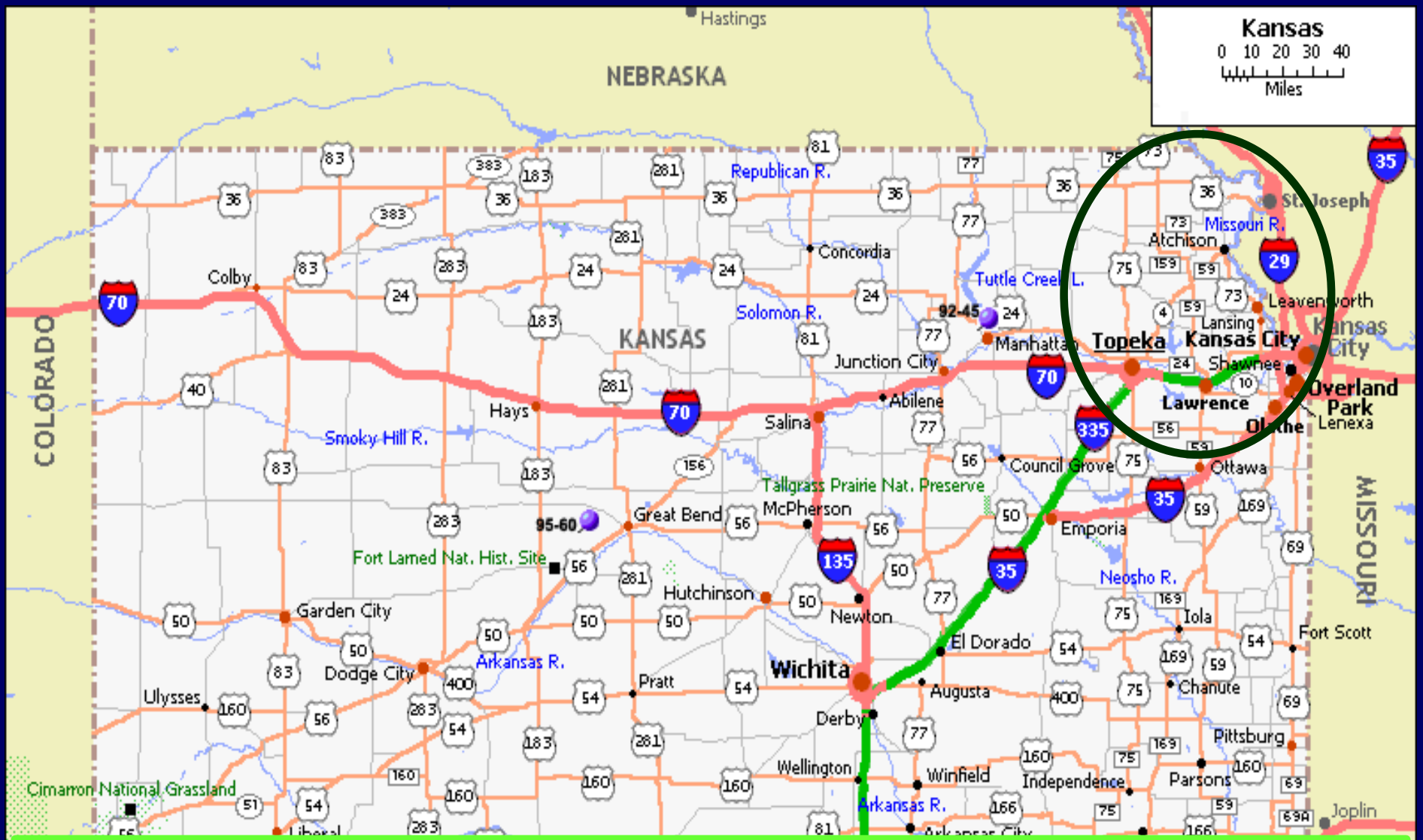
Photograph by Art Wagner

Photograph by MI Department of Agriculture

Progressive injuries ultimately lead to tree death, usually within five years of a tree initially being colonized

Emerald ash borer was accidentally introduced into and has since spread through North America





Eight Counties In Kansas Are Quarantined Due To Detection Of The Emerald Ash Borer: Wyandotte, Johnson, Leavenworth, Douglas, Jefferson, Atchison, Doniphan, And Shawnee

How does Emerald Ash Borer compare to the borer we already have in ash - Lilac/Ash Borer?

Lilac/ash borer, a clearwing borer moth

Emerald ash borer, a metallic wood borer/ flatheaded borer


Photograph by Debbie Miller

Emerald ash borer

Agrilus plannipennis


Photograph by David Cappaert

Order Coleoptera (beetles)

Family Buprestidae (metallic wood borers, flatheaded borers

Lilac/Ash Borer

Podosesia syringae

Order: Lepidoptera (Moths and butterflies)
Family: Sesiidae (Clearwing borers)

Emerald ash borer larvae create meandering tunnels in the cambium that produce girdling wounds.

Note: **Attacks can occur throughout the crown and on the trunk of the tree.**

Photograph by Eric Day

Photograph by
David Cappaert

Lilac/ash borer larvae create irregular gouging wounds that extend often into the heartwood.

Attacks are concentrated at the lower trunk of the tree

EAB adults chew through the bark, producing D-shaped exit holes

Chewing of the exit hole is done by the larva of the lilac/ash borer – the adult stage cannot chew.

Lilac/ash borer emerges from *irregularly round holes*. The pupal skin is pulled out when the adult emerges.

After emergence emerald ash borer adults feed on ash foliage for a period and eggs mature.

Photograph by David Cappaert

EAB likely will emerge sometime in midMay.

Eggs will be laid in June and into July

Photograph by Dan Herms

Adult stages of the lilac ash borer do not feed on any parts of the ash tree.

Male flying to a pheromone trap

Adults of the lilac/ash borer are present in mid-late spring. Most eggs are generally laid in May through early June.

Eggs of both species are laid on the bark of the host tree

EAB egg

Clearwing borer eggs

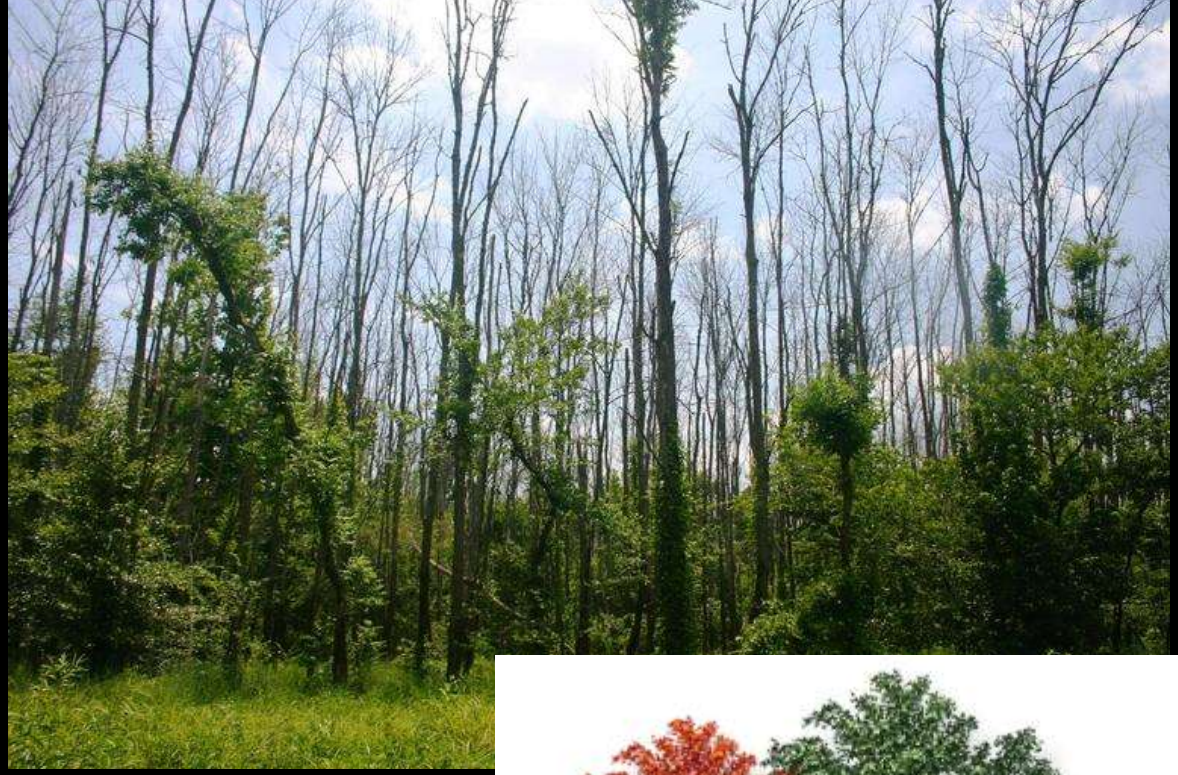
Damage potential to its host

2, maybe 3 – Lilac/ash borer has far lower ability to seriously damage its host

Damage potential to its host

10 – EAB now defines an aggressive tree killing insect in North America.

Emerald ash borer ***is devastating to all species of ash that are native to North America***



Green ash

White ash

Why is EAB so destructive to ash trees in North America?

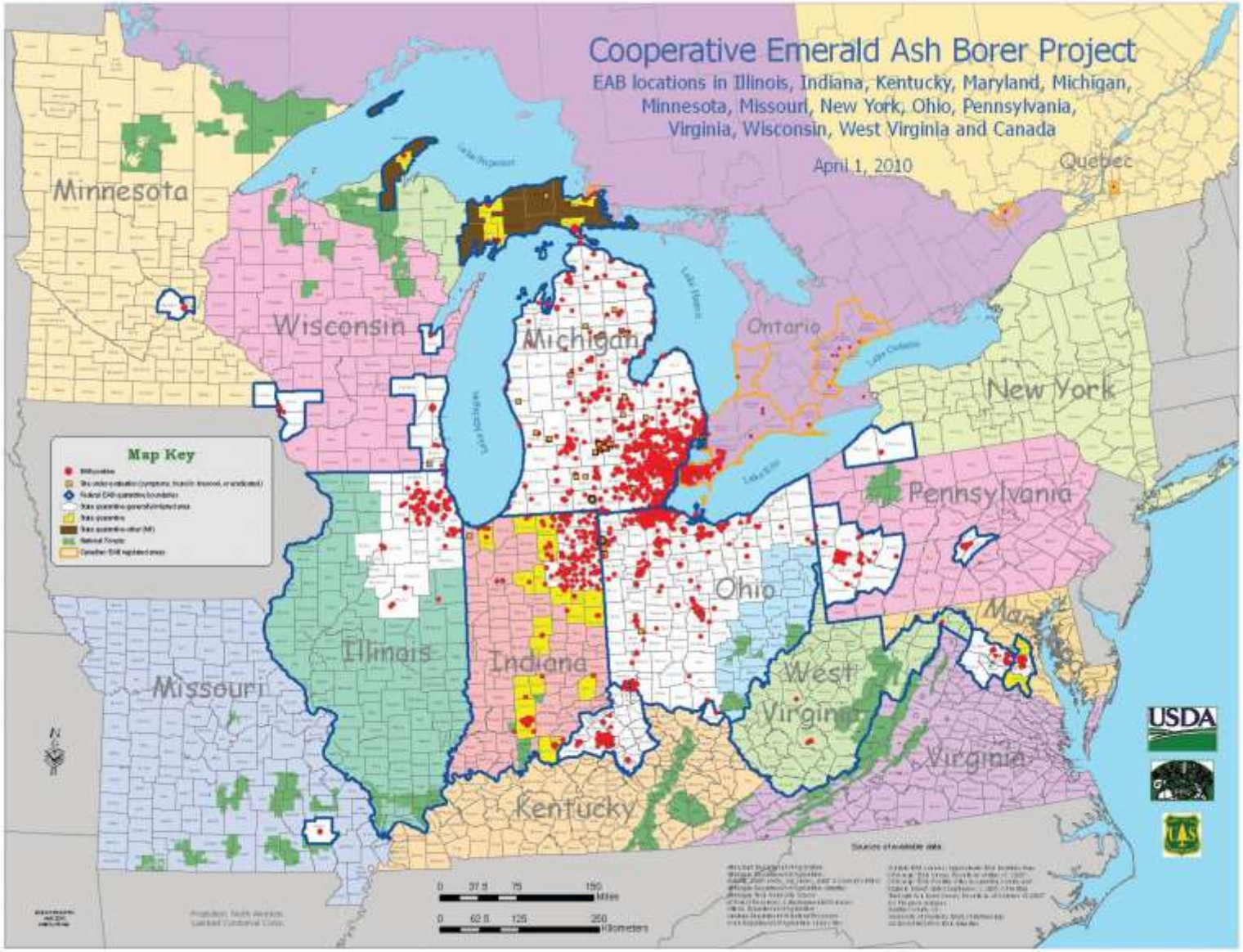
NA ash species lack ability to ability to resist EAB

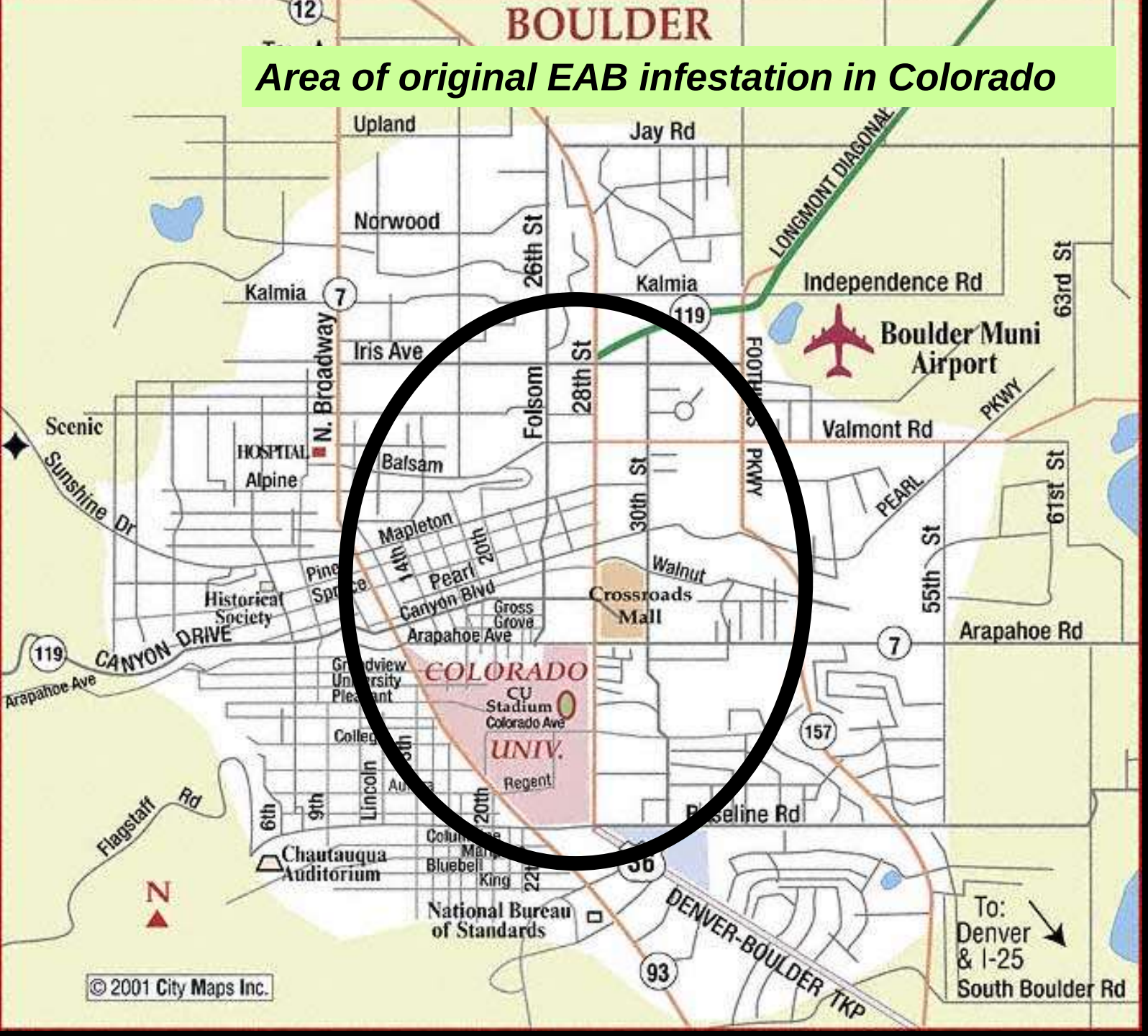
Colorado EAB Tree #1

Located near the intersection of 30th and Valmont, Boulder

September 23, 2013

Known positive locations of emerald ash borer as of April, 2010




Area of original EAB infestation in Colorado
BOULDER
Upland
Jay Rd
LONGMONT DIAGONAL
Norwood
26th St
Kalmia
Kalmia
Independence Rd
63rd St
Boulder Muni Airport
Iris Ave
N. Broadway
Folsom
28th St
FOOTHILLS PKWY
Valmont Rd
PEARL PKWY
Scenic
Sunshine Dr
HOSPITAL
Alpine
Balsam
30th St
61st St
Mapleton
14th
20th
Pearl
Canyon Blvd
Walnut
Crossroads Mall
55th St
Historical Society
Gross Grove
Arapahoe Ave
Arapahoe Rd
CANYON DRIVE
Arapahoe Ave
COLORADO
CU Stadium
Colorado Ave
UNIV.
Regent
Lincoln
6th
9th
20th
Flagstaff Rd
Pleasant
Chautauqua Auditorium
Bluebell
King
National Bureau of Standards
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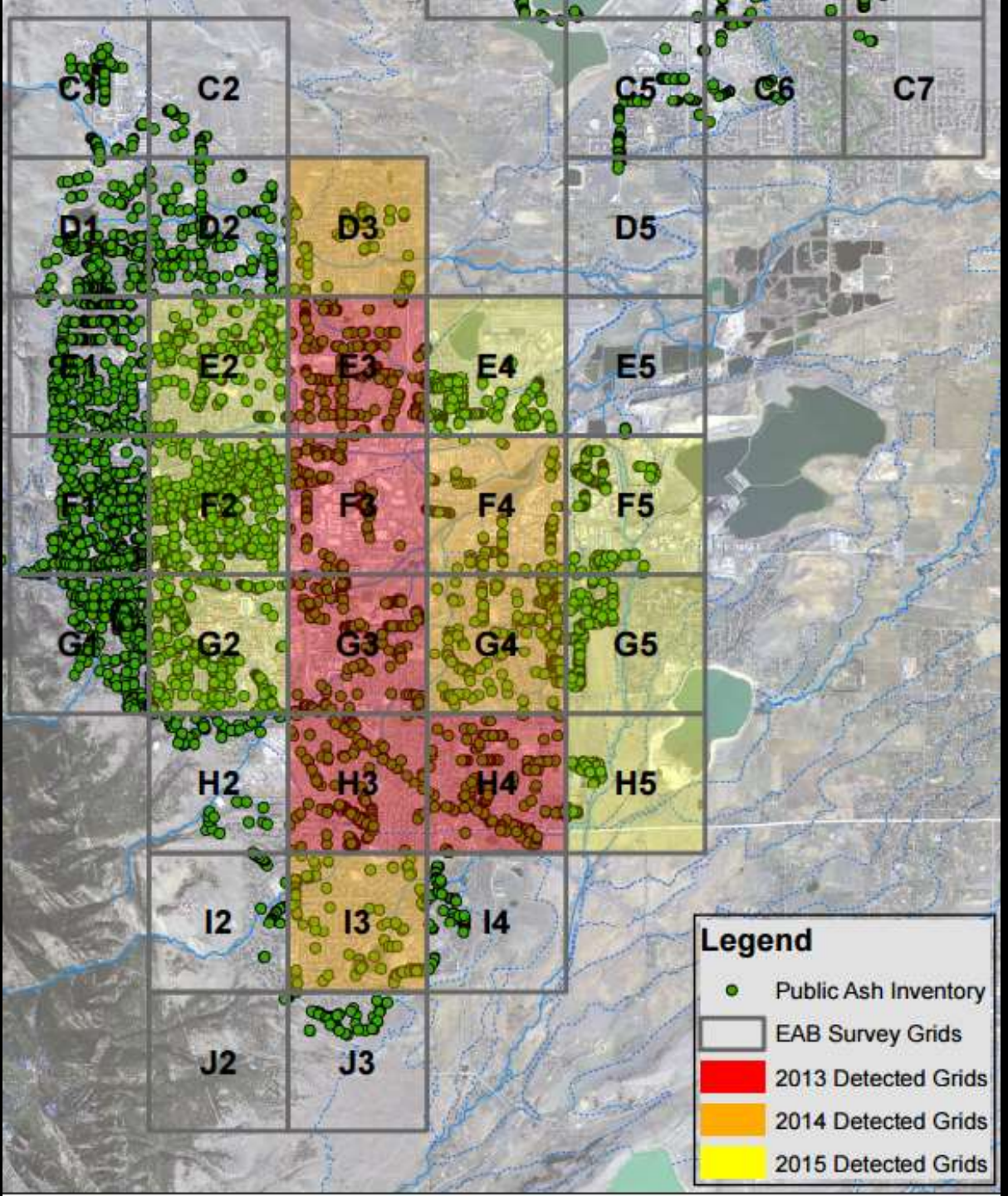
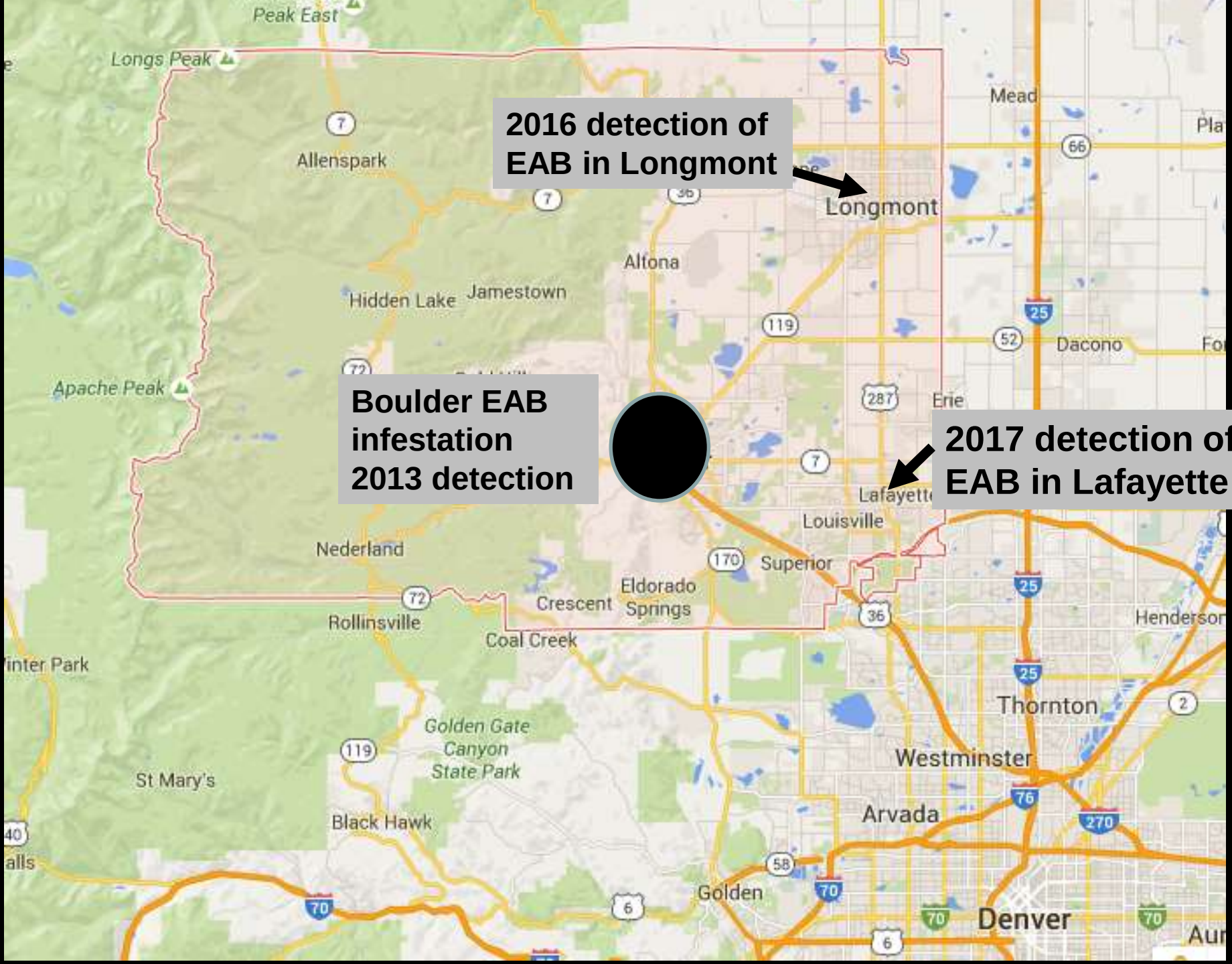


Areas known to be infested with emerald ash borer in Boulder (original site of Colorado establishment)


2016 detection of EAB in Longmont
Boulder EAB infestation 2013 detection
2017 detection of EAB in Lafayette
Peak East
Longs Peak
Allenspark
Mead
Longmont
Altona
Hidden Lake
Jamestown
Dacono
Apache Peak
Erie
Lafayette
Louisville
Nederland
Superior
Eldorado Springs
Crescent
Rollinsville
Coal Creek
Henderson
Thornton
Golden Gate Canyon State Park
Westminster
St Mary's
Arvada
Black Hawk
Golden
Denver

Known CO distribution of emerald ash borer as of today

- Known infestation is still presently confined to areas within Boulder County limits
  - Steady expansion has occurred within the original areas of infestation
    - Tree decline symptoms are advancing as predicted in core area of infestation
  - Detections have been made in two adjacent communities

Known CO distribution of emerald ash borer as of today

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  - Steady expansion has occurred within the original areas of infestation
    - Tree decline symptoms are advancing as predicted in core area of infestation
  - Detections have been made in two adjacent communities
  - *Extensive trapping and surveys conducted in 2017 have still not detected EAB anywhere outside Boulder County*

How will EAB spread once established?

- Wind-blown dispersal of adults
  - Peak period of adult dispersal is late May through late July
- Butt-heads that move wood containing developing stages

Photograph by David Cappaert

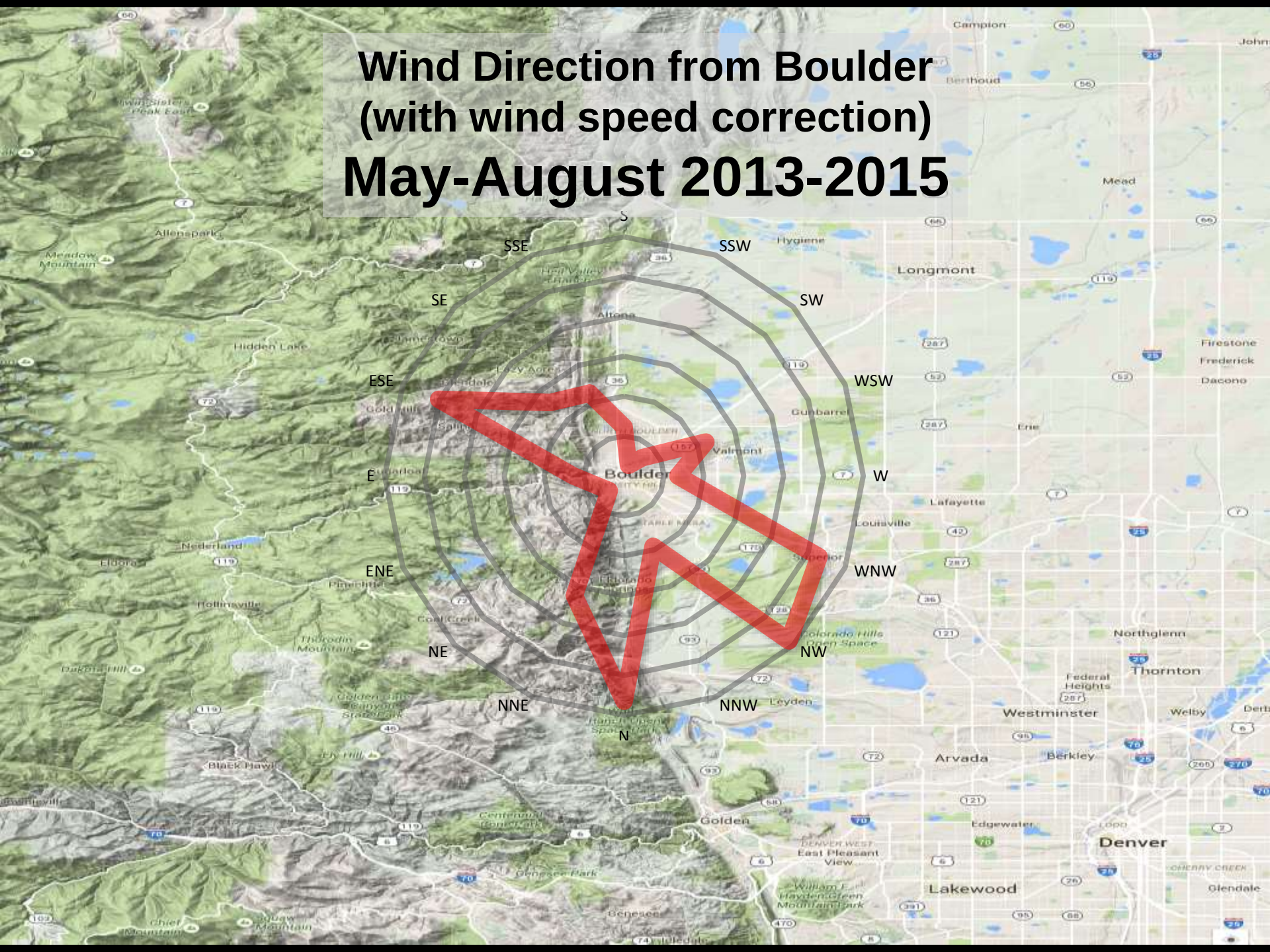
EAB likely will emerge sometime in mid-late May.

Most eggs will be laid in June, egg laying will continue through summer

Photograph by Dan Herms

Wind Direction from Boulder (with wind speed correction)

May-August 2013-2015



How far away is emerald ash borer from your community?

How far away is emerald ash borer from your community?

One truckload

Detecting Emerald Ash Borer

Symptom that will develop as EAB injuries accumulate –
Progressive dieback of the crown






ADIOS condition of regional ash greatly complicates EAB detection

ADIOS - Ash Decline of Idiopathic Origins

- Residual effects of drought
- Residual effects of freezing injuries
- Cumulative effects from secondary pests
  - Ash bark beetles
  - Cytospora cankers
- ??????

Possible symptom of EAB injury – irregular yellowing of the foliage

Leaf size decreases in EAB affected trees

Meandering tracks under the bark of ash always indicate some flatheaded borer. They will *almost always* indicate emerald ash borer.

Bark cracking can be a good clue that EAB may be present in a tree

A good place to look is the underside of limbs, particularly in the area near the trunk

Peeling the bark away from a cracked area may reveal earlier larval tunneling

Detecting Emerald Ash Borer

Look for D-shaped exit holes in ash trees

There is at least one other species of flatheaded borer in ash which makes D-shaped exit holes and a larval tunneling pattern under the bark…

Flatheaded appletree borer

A generalist flatheaded borer/metallic wood borer that is associated with many hardwoods that are in decline

Detecting Emerald Ash Borer

The presence of the insect is a positive detection

Regional metallic wood borers with some resemblance to EAB

Cypriacus intricata

Buprestis confluenta

Agrilus cyanescens

Agrilus lacustris

Emerald Ash Borer and Colorado Insects of Similar Appearance

Adults of the emerald ash borer (*Agrilus plannipennis*) have an elongate, rather bullet-form body, typical of most beetles in the metallic wood borer/flatheaded borer family Buprestidae. Emerald ash borer is about 9-13 mm in length, large for members of the genus *Agrilus*, but mid-sized for most other members of this insect family.

Emerald ash borer. Photograph by Pennsylvania Department of Natural Resources

Perhaps the most conspicuous feature is that the emerald ash borer has uniformly green bright, metallic wing covers, sometimes with slight purplish hues. The thorax may be more metallic brown and underneath the wing covers the abdomen is purple. Adults are active between late May to midAugust and almost always they would be found on the leaves or bark of an ash tree.

Many metallic colored beetles that may be mistaken for emerald ash borer

Other wood boring insects can be found in ash trees

Lilac/ash borer



Flatheaded appletree borer

A generalist flatheaded borer/metallic wood borer that is associated with many hardwoods that are in decline

Flatheaded appletree borer larvae produce dry, powdery sawdust excrement

Ash bark beetles

An important contributor to limb dieback in Colorado ash

Ash bark beetles usually are found in limbs – but can occur in the trunk

Redheaded ash borer

Two roundheaded borers/ longhorned beetles occasionally occur in ash trees in advanced decline

Banded ash borer

Wood Boring Insects of Ash Trees

Ash is one of the most widely planted trees in Colorado, with most plantings involving various cultivars of green ash (*Fraxinus pennsylvanica)* or white ash (*F. americana*). Several insects are associated with these plants, including leafcurling aphids, various caterpillars and sawflies that chew the leaves, and wood borers and bark beetles that develop within the trunk and limbs of the tree.

The wood borers and bark beetles can be particularly difficult to identify since there is minimal evidence of their activity on the surface of the plant and there is some overlap in the injuries that different species produce. Furthermore, there is greatly increased interest in these insects since the 2013 discovery of a new wood borer, the emerald ash borer, in Boulder County. With the addition of this new species there are now over a half dozen insects that may be found tunneling into trunks and branches of ash trees growing in Colorado: lilac/ash borer, flatheaded appletree borer, emerald ash borer, redheaded ash borer, banded ash borer, pigeon tremex, ash bark beetles (2-3 species) and ambrosia beetles.

Major Wood Borers of Ash

Lilac/ash borer. The lilac/ash borer (*Podosesia syringae*) is a native insect to North America and the most commonly encountered wood borer found in ash throughout Colorado. It is a type of moth in the "clearwing borer"

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- How do you define control?

- Will you be able to eliminate it from the state?
- Will you be able to slow its spread?
- Will you be able to protect individual trees?

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- Will you be able to save individual trees?
  - **Definitely yes. There are some highly effective treatments – but they are $$$ and must be sustained for the life of the tree.**

Control Options for Management of Emerald Ash Borer


Ash Tree Treated
For Emerald Ash Borers
Untreated Ash Tree

Important note regarding EAB control

Present controls can allow trees to recover if EAB-induced crown thinning has not exceeded 30-50%

Canopy thinning is related to the amount of tunneling injury

0%

10%

20%

30%

40%

50%

Emerald Ash Borer Insecticides

- **Imidacloprid** (Merit, Xytect, Criterion, etc.)
- **Dinotefuran** (Safari, Zylam, Transtect)
- **Emamectin benzoate** (TREE-Age, Arbormectin, others)
- **Azadirachtin** (Treeazin, Azasol, others)

Adults as they feed on foliage

Young larvae that tunnel in the phloem and cambium

Target Life Stages for EAB Treatments

Emerald Ash Borer Control Options

- Soil applications with systemic insecticides
  - imidacloprid, dinotefuran
- Non-invasive trunk sprays of systemic insecticides
  - dinotefuran
- Trunk injections of systemic insecticides
  - emamectin benzoate (TREE-Age), azadirachtin (TreeAzin), imidacloprid

Soil application option – imidacloprid applied as drench or injection

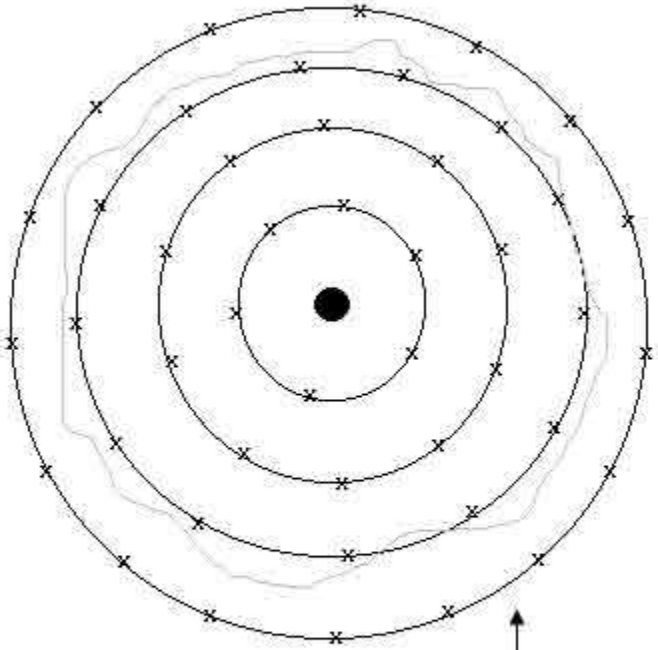
Primary method of imidacloprid application – soil applications for root uptake

Applying systemic insecticides to the soil of trees

Soil drench

Soil injection

Soil Injection Patterns



Circular Pattern

Injections are made at each "X" spaced apart every 2.5-feet.
Rings are also spaced apart by 2.5-feet.

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A circle of 40-ft diameter (i.e., 40-ft canopy spread) covers 1250 sq ft.

Bird's eye views from above the tree looking through the canopy to the ground. The dark spot represents the trunk, while the irregular grey line represents the border of the canopy (the drip line).


07.07.2011

Soil applications of systemic insecticides should not be made if there are flowering plants at the application site

Fall Applications vs. Spring Applications?

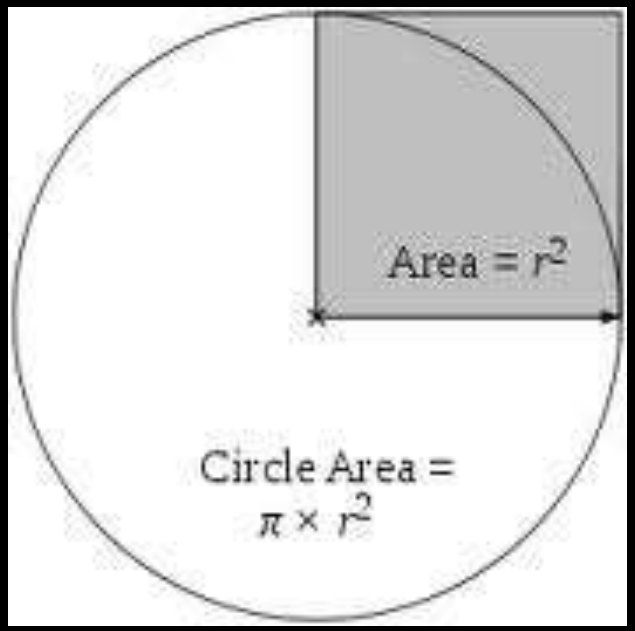
Spring applications are more efficient/Less product required

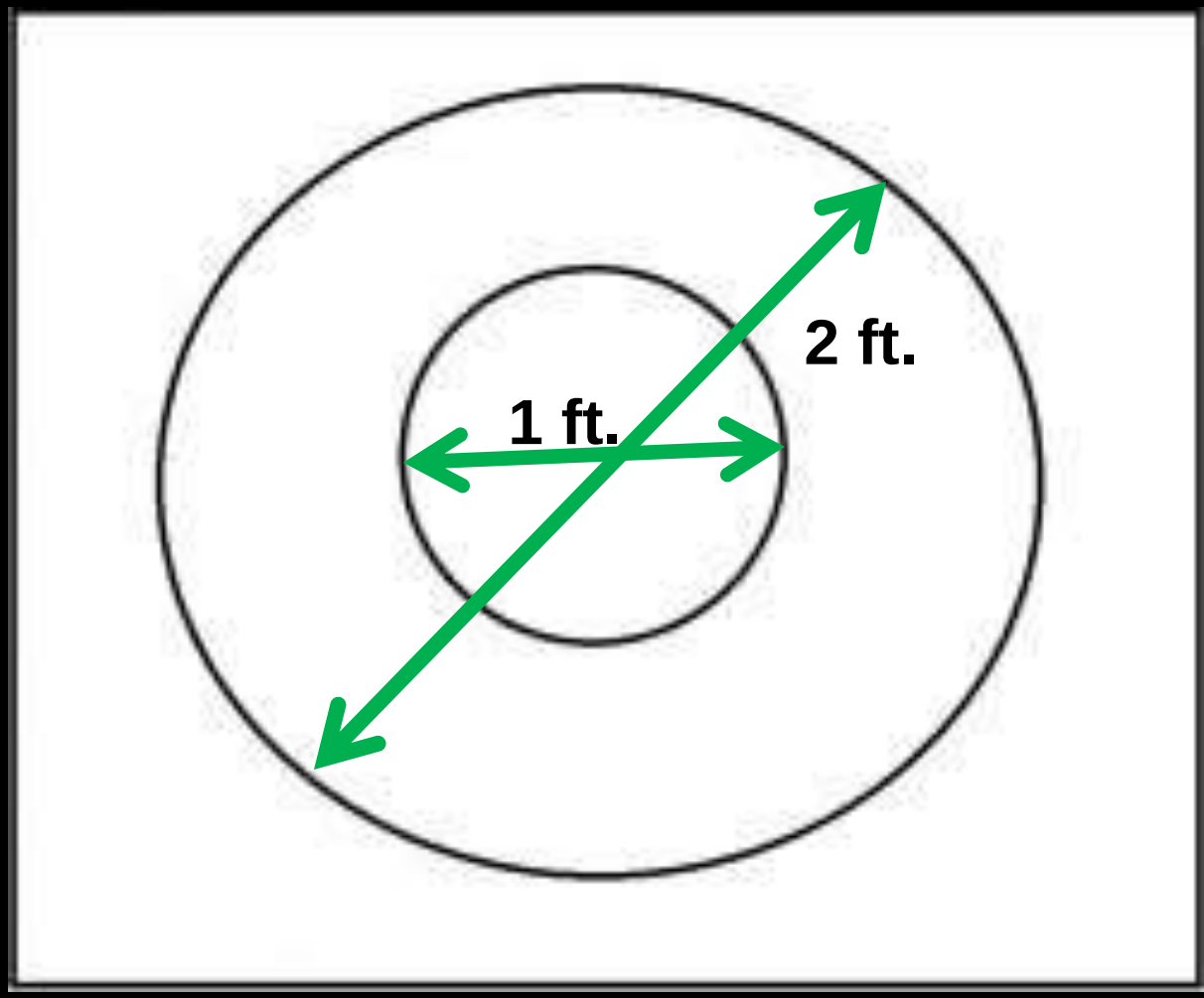
Modifying DBH-based rates by tree size

What rate of use for imidacloprid soil treatments?

- 1X rate = 1.4 grams active ingredient/inch trunk diameter
- Rates of use allowed in label directions
  - 75 WP formulation - 1X/application
  - 2F and 75WSP formulations - 1X up to 15 inches diameter; 2X in larger trees
  - Retail nursery formulations – 1/2X
    - Limited to single application/year

Area increases as the square of the width (diameter)





Example: A circle that is 2 ft. wide has an area 4X greater than a circle of 1 ft. diameter

Bottom line: Larger trees have proportionately much greater volume than do smaller trees. Insecticides rates based on DBH will be more diluted in larger trees.

Use of High or Low Rates of Imidacloprid?

Low Rates (1X)

- Smaller trees
- EAB populations low, moderate
- Spring applications

High Rates (2X)

- Large trees
- High EAB populations present (peak outbreak phase)
- Fall applications

Basal trunk spray with dinotefuran (Safari, Zylam)

Trunk Injections

Trunk injection with emamectin benzoate (TREE-age)

New formulations of emamectin benzoate are coming onto the market. This should decrease costs.

Boxer

Emamectin benzoate formulation used with Wedgle/ArborSystems injection system

Trunk injection with azadirachtin (TreeAzin, Azasol, AzaGuard, etc.)

Ash Biopsies

We are injecting more trees due to emerald ash borer – what is the effect on the tree?

Arboriculture & Urban Forestry 2011. 37(1): 6–12

Tree Wound Responses Following Systemic Insecticide Trunk Injection Treatments in Green Ash (*Fraxinus pennsylvanica* Marsh.) as Determined by Destructive Autopsy

Joseph J. Doccola, David R. Smitley, Terrance W. Davis, John J. Aiken, and Peter M. Wild

Abstract. Trunk injection of systemic insecticides or fungicides is an effective way to manage destructive insects or diseases of trees, but many arborists are still reluctant to inject trees because of the potential for infection by pathogens, structural damage, or adverse effects on tree health. The authors of the following study examined wound responses of green ash (*Fraxinus pennsylvanica* Marsh.) for two years following trunk injection, by sectioning tree trunks to look for evidence of infection associated with injection sites, and by collecting data on annual radial growth and rate of closure around injection sites. All healthy trees successfully compartmentalized injection wounds without any signs of infection, decay, or structural damage. Wound closure was positively correlated with the tree health as measured by annual radial growth.

Key Words. Canopy Dieback; Decline; Emerald Ash Borer; Stem Injection; Systemic Insecticide; Tree Health; Wound Closure; Woundwood.

“wound closure rates are strongly dependent on tree health as expressed by ring growth.”

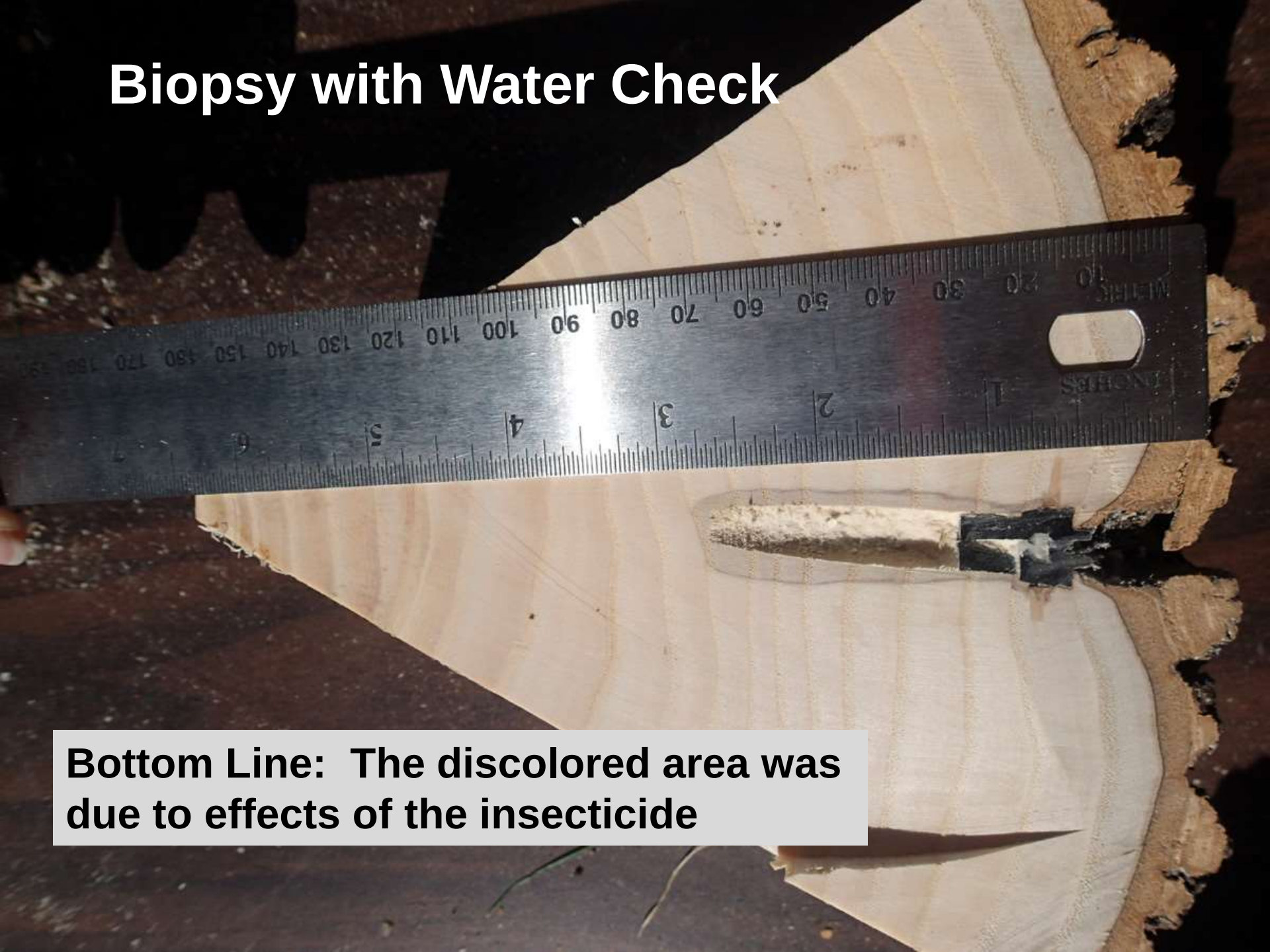
Biopsies of Green Ash Trunk Injected in June 2014

Discoloration is present in areas where the insecticide was injected


Internal discoloration associated with another tree injection

A column of the discoloration typically extended at least a foot above the injection site

Biopsy with Water Check



Bottom Line: The discolored area was due to effects of the insecticide

In the trees dissected in September 2015 good wound closure was noted and there was no evidence of decay.

Ash biopsy showing wound closure after 5 years in Michigan.

Wound closure will differ among trees, largely due to site/health of the tree. And effects of trunk injections could be cumulative.

And when injections cause cracking and produce poorly closing wounds ????

There are several tree injection systems

Main Points About Emerald Ash Borer in Colorado Today

- **Known infestation presently confined to areas within Boulder City limits and a limited areas of Longmont, Lafayette**
  - In time will spread throughout South Platte drainage
- **Treatments are available that can protect individual trees once they first become infested**
  - Each treatment option involves decisions balancing costs, environmental hazards, effectiveness, and ease of application

Entertaining visitors from the East this year? – Tell them you will provide all the firewood they need.

This presentation will be posted at the Insect Information web site

- Housed at Department of Bioagricultural Sciences and Pest Management
  - Search "BSPM CSU"
- Within "Extension and Outreach"
- "Insect Information"
  - Extension presentations for 2018 posted at bottom of page